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SUMMARY
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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.5.1

India

INDUSTRIAL DEVELOPMENT : PULP AND PAPER

By A. SEETHARAMIAH
and N. NARASIMHAN

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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Agenda item: D: INDUSTRIAL DEVELOPMENT

D.5.1: Pulp and Paper

(By A. Seetharamiah and N. Narasimhan)

Authors' Summary

EARLY HISTORY

1. Paper industry, which was established in India nearly 100 years ago, has been steadily growing. The industry took early advantage of the researches carried out in India, which established the use of bamboo as a raw material for paper manufacture. The production which was about 93,000 tons in 1947 increased to 193,000 tons in 1956 and to 364,118 tons in 1961. The per capita consumption is one kilo/year.

PRESENT POSITION OF THE INDUSTRY

2. At present there are 30 paper and paper board mills, 27 strawboard mills and one newsprint mill, with a total capacity of 546,200 tons/year. Most of the existing paper mills are integrated units which manufacture pulp for conversion to paper. There is no unit producing only pulp. The industry has an investment of about Rs. 40 crores and provides direct employment to 34,000 persons. All the common varieties of papers and boards are now being manufactured. Steps have been taken to produce specialty papers, the demand for which is small.

FUTURE PLANS FOR DEVELOPMENT

3. The following targets of production are to be achieved by 1965/66:

Paper and paper boards	..	..	700,000 tons/year
Newsprint	..	..	150,000 tons/year
Dissolving Pulp	..	..	100,000 tons/year

The present capacity for paper and paper boards is 433,800 tons. Additional capacity of 769,840 tons/year has been licensed. Three new newsprint mills with a capacity of 150,000 tons/year (two of which are bagasse based) and seven schemes for dissolving pulp with a capacity of 276,600 tons have been licensed. It is expected that the per capita consumption of paper would increase to about 7 kg. by 1980-81; the perspective planning is for expansion of capacity to 3 million tons of paper and paper boards and 0.6 million tons each of newsprint and chemical pulp.

4. The present trend is to establish large economic units with capacity of 100 tons/day and more and also to expand the existing smaller mills to this level.

ROLE OF SMALL UNITS OF 5-10 TONS/DAY CAPACITY

5. It is considered that there is scope for a limited number of smaller units near large cities where auxiliary raw materials like waste paper and rags could be collected easily and where other services such as power, water and facilities for effluent disposal would be readily available.

POSITION OF RAW MATERIALS

6. Bamboo at present constitutes about 80% of all cellulosic raw materials used. Sabai grass (ELIOPSIS BINATA), Salai (BOSWELLIA SERRATTA) and bagasse are also being used to a limited extent. Recently, attention has been paid for large utilization of hard woods and agricultural residues.

RAW MATERIALS FOR THE FUTURE DEVELOPMENT

7. Steps are being taken to ensure adequate raw materials for future development by (a) increasing the yield of bamboo from the existing forests (b) undertaking plantation of suitable fast-growing species of timbers and bamboo as under-cover (c) encouraging sugar mills to release bagasse, for paper manufacture by effecting economics in the use of fuel and by using alternative fuel; (d) harnessing agricultural residues (e) encouraging Paper Mills to intensify collection of waste paper and rags and (f) harnessing the soft wood resources of the lower Himalayan region.

RESEARCH AND DEVELOPMENT

8. The Indian Paper Industry had to be developed on unconventional indigenous raw materials. The two-stage sulphate process for pulping of bamboo developed in the Forest Research Institute is now being widely adopted with slight modifications by all the paper mills except one which adopts the Mg base acid sulphite process. All the sulphate mills recover chemicals for re-use.

9. Based on work done in the Dehra Dun Institute, and U.S.A., newsprint manufacture utilizing 65% ground wood pulp from salai (BOSWELLIA SERRATTA) and 35% bleached bamboo kraft pulp has been undertaken in a 100 tons day mill. For expansion of this mill the use of "Palas" (BUTEA MONDSPERINA) is contemplated. Pilot plant and semi-commercial production are to be undertaken shortly. The problems of regeneration of these species of hard woods are under investigation.

10. Studies to utilize bamboo and bagasse for dissolving pulp manufacture have been undertaken. Pilot plant work carried out in India, Japan and U.S.A. has established the technical and economic feasibility of using bamboo for dissolving pulp. The first unit with a capacity of 54,000 tons/year is to start production during 1962-63. The work on bagasse is continuing.

11. Studies undertaken in India, U.S.A., West Germany and Japan has established the technical feasibility of newsprint manufacture with a high bagasse-pulp furnish. The economics of production, establishment of optimum conditions for pulping and production on high-speed machines are under study. Constant attention is being paid to increase the yield of pulp, recovery of chemicals and fuel efficiency.

MANUFACTURE OF PLANT AND MACHINERY

12. The country is now dependent on imported plant and machinery. Schemes have been approved for the manufacture of pulp and paper machinery in the country in collaboration with some of the reputed overseas manufacturers.

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Agenda Item: D.14

United Kingdom

THE INDUSTRIALISATION OF BUILDING TECHNIQUES

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THE INDUSTRIALISATION OF BUILDING TECHNIQUES

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Chief Architect (Development), War Office, London.

1. The first part of this paper briefly describes the present position in the United Kingdom. The second part suggests some principles, based on the U.K. experience, which may be applicable in the less developed areas.

PART I. THE PRESENT POSITION IN THE UNITED KINGDOM

The need for industrialisation

2. The expenditure on construction work of all kinds in the U.K. was £2138 millions in 1961. Deducting civil engineering work, the expenditure on building was £1620 millions. At a conservative estimate, it is expected that the demand for building will increase by an average of about 3% per year. This means that the output of the building industry must be approximately doubled in 25 years. But, during this time, the labour force available is not expected to increase by more than 5% .

3. There has already been a substantial increase in the use of mechanical plant on the construction of buildings designed in the conventional way, i.e. where brickwork, in-situ reinforced concrete or steelwork encased in concrete are the principal structural materials. Tower cranes, ready mixed concrete, mechanical hoists and power tools are extensively used. But it is now being recognised that the required improvement in the output of the industry can only be achieved by radically changing the way in which buildings are designed.

System of prefabrication

4. A great many systems of prefabricated construction have been invented in the U.K. since the war. The most successful are the 'light and dry' systems designed primarily for school building. Some of these have been designed by architects in central or local government authorities; others by commercial firms. They consist essentially of factory made components which can be assembled together to make buildings of any required plan form. The objective is to be able to design buildings of the greatest possible variety with the least possible number of types and sizes of components.

5. Other kinds of system include those using large, heavy components in pre-cast concrete which have been developed mainly for multi-storey flats and office buildings. Systems are now being introduced from other European countries in which concrete is cast on site in highly standardised formwork.

The CLASP system

6. The most widely used of the 'light and dry' methods of construction is the CLASP system. The first CLASP school was erected in 1957; the first year's programme in 1957-58 amounted to £0.8 millions; the value of the 1962-63 programme is about £10 millions.

7. The CLASP system consists 50% of factory made components. These include the light steel frame, heating system components, pre-cast concrete cladding, window frames, aluminium sliding windows and ventilating louvres, rubber floor finishes, eaves units, roof lights, light gauge steel vitreous enamelled panels, internal doors, pre-fabricated partitions and sanitary fittings.

8. In the CLASP frame, beams consist of welded lattices of hot rolled and cold rolled angle sections with a flat lower chord. Stanchions are of box section made from cold rolled light gauge steel strip, or hot rolled square tube, according to the load.

9. CLASP buildings are designed on a planning grid of 3'4"; external walls may change direction at 6'8" or 10'0" intervals; buildings may be up to 4 storeys high.

10. A number of public authorities have formed a consortium to use the CLASP system whereby they pool their requirements for the factory-made components and orders for these are placed centrally. CLASP buildings are now cheaper than buildings of conventional construction of equivalent quality. Erection times are considerably faster.

11. The CLASP system is now being used in Germany and Italy. A modified version of it, with a 1'8" planning grid, is being developed for 2 to 3 storey low cost housing.

Other systems being developed

12. At the present time, several other systems are being developed, based on the CLASP experience. One of these is the NENK method of building which is being designed in the War Office. Here the system must be able to cater for a wide variety of different types of permanent building; higher performances in loading, sound insulation and fire resistance are also needed. The NENK method has a light steel structural frame in which the floors and roofs are of space frame construction. This allows more freedom in planning: internal partitions may be placed on any 4" interval; external walls may change direction at 4'0" intervals. At the present stage of development, buildings may be up to 4 storeys high.

The long term aim

13. The 'light and dry' systems of pre-fabricated construction, now current in the U.K., may be regarded as an intermediate stage in the progress towards fully industrialised building techniques. At present the components for each system have to be specially ordered according to the size of the programme. The long term aim is to have factory-made components available on the free market; components which are well-designed functionally and aesthetically, which are dimensionally co-ordinated, and which are interchangeable with one another. Up to now, components can only be used within the system for which they have been designed. A great deal more work on dry-jointing techniques needs to be done before they can be made freely interchangeable.

Statements of future demand

14. In the U.K. about 50% of building is in the public sector; in other words, commissioned by central Government departments, local authorities and the nationalised industries.

15. Traditionally, programmes of public building have been determined from one year to the next. But this has left too much uncertainty; designers have not been able to look far enough ahead; the incentive to develop radically new techniques has been lacking.

16. It is where large client authorities have been able to state their future demands for longer periods ahead, e.g. for schools, that rapid technical development has taken place.

Development groups

17. Another very important factor has been the formation of development groups in central Government departments. Development groups are now at work in the Ministries concerned with schools, housing, hospitals and buildings for the Army.

18. Development groups usually consist of architects, administrators and quantity surveyors. Their functions are:-

(a) To study human activities in great detail, in order to establish the real needs of the users of buildings;

(b) To evolve new planning solutions and to design furniture and equipment;

(c) To invent techniques appropriate to the efficient erection of a large number of buildings carried out in a planned sequence;

(d) To study cost and cost control;

(e) To study building management, i.e. the way in which all members of the building team work together.

19. Development groups carry out actual projects onto which they focus their studies and by which they test their new ideas in practice. Such groups have originated many of the industrialised building techniques now in use.

Modular coordination

20. In the U.K., national agreement on modular coordination has not yet been reached, but most of the designers of systems of industrialised building are using nominal dimensions which are multiples of 4".

Cost planning

21. Quantity surveyors in the U.K. have evolved a technique for fixing the target cost for a building, in cooperation with the architect, at the early stages of planning. The target cost is broken down into costs for each element (frame, roof, floor, internal partitions etc), measured in shillings per square foot of the total floor area of the building. Throughout the design stage, the cost of each element is checked. The total cost of the building is thus kept under control at all times.

22. Cost planning has been of very great value to the designers of systems of industrialised building.

Cooperation with component manufacturers

23. Some of the best technical development in the U.K. has occurred when there has been active cooperation between architects and the manufacturers of components such as structural frames, cladding panels, heating systems and sanitary fittings.

Manufacturers have usually been glad to cooperate on development work where the intention is to standardise components for quantity production in relation to a firm building programme.

PART II. THE APPLICATION OF U.K. EXPERIENCE IN LESS DEVELOPED AREAS

Principles common to all countries

24. At first sight, the recent experience in the U.K. may seem to have little application in the less developed areas. The work which is now proceeding in the U.K. is based on a comparatively high level of professional and technical skills; on a relatively sophisticated manufacturing industry; on a fairly well trained body of operatives; and is taking place in a small country without serious problems of transport.

25. Nevertheless, there are certain principles which can be identified from the U.K. experience which are likely to be common to all those countries in which a rapid increase in the output of building is needed. Some of these principles are described in the following paragraphs.

Continuity of demand

26. The first principle is to establish continuity of demand. This implies Government action to survey the overall building requirements of the country for at least five years ahead and preferably more. Within this broad survey, the requirements can be sub-divided by types of building and in this way the major demands can be established. One of these will almost certainly be for housing and this demand can again be sub-divided into urban and rural housing, each of which may need a different approach. Other major demands may be for schools, industrial buildings, medical buildings and so on.

27. Having related these demands for building to the capital and resources which are likely to be available, programmes can be drawn up. It may be wise not to expect to make progress in industrialisation over the whole range of any one programme. It may be better to select part of each programme for special attention, remembering that the objective is to give those engaged on technical development the firm assurance that their part of the programme will in fact be carried out. Industrialisation will proceed rapidly only where there is real continuity of demand.

Formation of development groups

28. The second principle is to organise professional and administrative skills in an effective way. Given firm programmes for each type of building, it should be possible to set up development groups and to charge them with the task of working out industrialised building techniques appropriate to each programme. Each development group should contain the best available skills in design, cost control and administration. The role of such a group is first to study the functional requirements of the buildings in the programme and then to produce appropriate technical solutions. It is the responsibility of the group to produce results which are viable in the political, economic and technical contexts of its country. It is the responsibility of the parent organisation to which the group belongs to apply the group's findings as widely as possible. The parent organisation should preferably be a Government department, and the group should be so placed that its professional leader is directly responsible to the top

professional man in the department. The development group should build experimental projects but its work should be kept separate from that of the production teams responsible for carrying out the programme as a whole.

Assessment of resources

29. The first task of each development group is to assess the resources which can be brought to bear on its programme, for instance:-

(a) The capacity of the professional staff available to design individual buildings within the programme;

(b) The availability of raw and processed materials;

(c) The existing and potential capacities of the manufacture of building components.

(d) The capabilities of building contracting organisations, the availability of plant and the levels of skill of site operatives;

(e) The problems of geographical location and transport.

Choice of method

30. In the light of all the relevant factors, the group should be able to determine in principle which method of building to adopt for the programme. Three basic alternative methods may be distinguished, according to where the bulk of the machinery or plant is applied.

(a) 'Light and dry'. In this method the majority of the components are made by machines in factories and erection on site is reduced as far as possible to a semi-skilled assembly process. A framed system of construction is preferred, using steel, timber or aluminium as the principal structural material. Other components are also kept as light as possible, using such materials as lightweight concrete, timber, aluminium sheeting, chip-board, fibre-board, plaster-board, plastics etc. Sizes of components are controlled by transport requirements and by the need for simple handling on site. This method allows great flexibility in the design of individual buildings and buildings may be placed on any site which transport can reach.

(b) 'Heavy and dry'. Here the principal components are also prefabricated but of a size and weight which prohibits long-distance transport. A load-bearing panel system of construction is preferred, using reinforced concrete cast in large sizes with a high quality of finish. A central pre-fabricating plant is required and fairly heavy lifting devices must be available on sites. This method still allows a certain amount of flexibility in the design of individual buildings, but buildings can only be placed within a limited distance from the main plant. The use of the central prefabricating plant, after the main demand in its area has been met, needs to be considered in advance.

(c) 'Wet and heavy'. Here the building is not prefabricated, but the site operations are mechanised. A load-bearing system of in-situ concrete walls is preferred, using highly standardised formwork which can be quickly assembled and dismantled. Walls may be cast on edge or may be lifted in place after casting horizontally. This method requires a substantial amount of

equipment on every building site and a skilled labour force. It is most effective when building design has been completely standardised.

31. It is, of course possible to rationalise traditional methods of building; to improve processes such as brick-making, block-making, timber conversion, joinery production and so on; and to improve the level of organisation and skill of site operatives. But such improvements inevitably take a long time to accomplish. Any country which is faced with a large building demand may find it more effective to concentrate on industrialised techniques in the first instance; to choose those which are appropriate to its needs; and to arrange the training of its management, staff and operatives accordingly.

Integration of organisations with the building industry

32. The trend for the future is almost certainly towards the pooling of skills within the building process and towards the integration of organisations within the building industry. It can be a drawback to have a well established building industry which is fragmented according to traditional trades and crafts; in which the professional and contracting interests are firmly entrenched in numerous separate institutions. In this respect, the balance of advantage may well lie with the less developed countries of the world.

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